What is Claimed is:

1. A method of estimating the spatial variation of magnetic resonance imaging radio frequency (RF) signal intensities within an object from measured RF signal intensities of a uniform spin density medium surrounding the object, said method comprising:

acquiring a magnetic resonance image of an object bounded by a medium which is of essentially uniform spin density, on the length scale of resolution of the image;

formulating a semi-empirical mathematical model of the spatial variation in RF signal intensity within the said object; and

fitting said model to selected measured RF signal intensities of said surrounding medium to obtain an estimate of the spatial variation of magnetic resonance imaging radiofrequency (RF) signal intensities within said object.

2. A method according to claim 1 wherein said step of formulating said semi-empirical mathematical model of the spatial variation in RF signal intensity within the object comprises:

locating a plurality of points in a plane of said image which are notionally considered to act as apparent receivers of RF signals (hereinafter referred to as "RF receiver points"); and

formulating a spatial profile of RF signal intensity within said object in said plane of said image relative to the said RF receiver points.

3. A method according to claim 2 wherein said RF receiver points are located on said surrounding medium.

4. A method according to claim 2 wherein said spatial intensity profile is formulated in a manner which provides a concentric reduction in RF signal intensity with increasing distance from said RF receiver points.

5. A method according to claim 4 wherein said reduction in RF signal intensity is formulated as having the same rate of reduction in signal intensity with increasing distance from all said RF receiver points.

6. A method according to claim 5 wherein said spatial profile is formulated as having an exponential reduction in signal intensity with increasing distance from said RF receiver points.

7. A method according to claim 5 wherein said spatial profile is formulated as having a reduction in signal intensity with the reciprocal of the distance from said RF receiver points raised to a chosen power.

8. A method according to claim 6 wherein when the magnetic resonance image is acquired in an axial plane said semi-empirical mathematical model is formulated as:

$$I(x,y)=\sum_{n=1}^{N} I_n e^{-R\sqrt{(x-x_n)^2\left[1/f.\cos^2\theta_n+f\sin^2\theta_n\right]+(y-y_n)^2\left[1/f.\sin^2\theta_n+f\cos^2\theta_n\right]+(x-x_n)(y-y_n)\left[1/f.\sin 2\theta_n-f\sin 2\theta_n\right]}}$$

where x and y are image coordinates, $I(x,y)$ is the model of the spatial intensity profile of the RF signal, N is the number of RF receiver points, I_n is the estimated signal intensity at the n^{th} RF receiver point and is to be determined by the fitting procedure, R is the rate of decay in signal intensity with distance from the RF receiver points and is to be determined by the fitting procedure, x_n is the x position of the n^{th} RF receiver point, y_n is the y position of the n^{th} RF receiver point, f is the degree of ellipticity to the concentric reduction in RF signal intensity with increasing distance from the RF receiver points and is to be determined by the fitting procedure, and θ_n is the angular alignment of the major axis of the elliptical contour to the decay in the RF signal intensity

from the n^{th} RF receiver point with the coronal plane.

9. A method according to claim 6 wherein said semi-empirical mathematical model is formulated as:

$$I(x,y) = \sum_{n=1}^{N} I_n e^{-R\sqrt{1/f.(x-x_n)^2 + f.(y-y_n)^2}}$$

where x and y are image coordinates, $I(x,y)$ is the model of the spatial intensity profile of the RF signal, N is the number of RF receiver points, I_n is the estimated signal intensity at the n^{th} RF receiver point and is to be determined by the fitting procedure, R is the rate of decay in signal intensity with distance from said RF receiver points and is to be determined by the fitting procedure, x_n is the x position of the n^{th} RF receiver point, y_n is the y position of the n^{th} RF receiver point, and f is the degree of ellipticity to the concentric decay in RF signal intensity with increasing distance from said RF receiver points and is to be determined by the fitting procedure.

10. A method according to claim 9 wherein said selected measured RF signal intensities comprise pixels of maximal signal intensity in respective radial line segments of an image of the surrounding medium (hereinafter referred to as "selected pixels").

11. A method according to claim 10 further comprising connecting said selected pixels by a line to form a trace.

12. A method according to claim 11 further comprising said method further comprises deriving from said trace local maxima in signal intensity for each of said radial line segments.

13. A method according to claim 12 wherein when said magnetic resonance image is acquired in an axial plane said RF receiver points are located at the local maxima in signal

intensity of the said selected pixels.

14. A method according to claim 13 wherein when said magnetic resonance image is acquired in said axial plane the said local maxima in signal intensity of the selected pixels are no closer than 12 pixels.

15. A method according to claim 14 wherein said local maxima in signal intensity determined from the selected pixels serve as starting values for the signal intensities I_n of the said RF receiver points in the said fitting procedure.

16. A method according to claim 15 wherein said fitting procedure includes deriving an initial estimate of the rate R of decay of signal intensity with distance from said RF receiver points determined by:

locating local minima amongst said selected pixels in a manner consistent with determination of said local maxima;

for each RF receiver point locating two nearest local minima and fitting an exponential signal intensity decay curve as a function of the distance from the said RF receiver point to the signal intensities of the two local minima constrained to the signal intensity at the position of the said RF receiver point to determine an estimate of the rate R_n of decay in signal intensity with distance away from the said RF receiver point; and

calculating the average of the estimates of the rate of decay R_n in signal intensity with distance from each RF receiver point which is to be used as an initial estimate of R.

17. A method according to claim 9 wherein when the magnetic resonance image is acquired in the axial plane the elliptical contours of the decay in the RF signal intensity from a given RF receiver point have their minor axes approximately normal to a plane of an RF receiver coil

element of an MRI machine acquiring said image of said object in closest proximity to the given RF receiver point.

18. A method according to claim 11 wherein when the magnetic resonance image is acquired in the axial plane the angular alignment of each of the elliptical contours of the decay in the RF signal intensity from the RF receiver points is determined relative to said trace.

19. A method according to claim 18 wherein the angular alignment of the major axes of the elliptical contours of the decay in the RF signal intensity from the RF receiver points is determined relative to said trace by:

centering a window kernel on each RF receiver point and finding the two furthest positions from said RF receiver point at which said trace of the selected pixels passes through the perimeter of the window kernel; and

calculating an angle of a line bisecting said two furthest positions relative to the coronal plane.

20. A method according to claim 19 wherein said window kernel which is centered on said RF receiver points to determine the angular alignment of the elliptical contours of the decay in the RF signal intensity from said RF receiver points is a square window kernel not less than 13 pixels in width.

21. A method according to claim 9 wherein said model spatial intensity profile $I(x,y)$ is fitted to the image intensities of the selected pixels for optimum parameterisation of I_n, R and f to obtain an estimate of the spatial variation in RF signal intensity throughout the object.

22. A method according to claim 9 wherein said method further comprises determining a RF spatial attenuation profile with which to rescale the magnetic resonance image intensities within the said object and thus minimise the spatial variation in RF signal intensity throughout the object.

23. A method according to claim 22 wherein said RF spatial attenuation profile is determined by dividing the estimated RF signal intensity profile $I(x,y)$ by the minimum or maximum value of $I(x,y)$ within the region occupied by the object.

24. A method according to claim 23 wherein the spatial variation in RF signal intensity throughout the object is be minimised by dividing the image intensities within the object by the RF spatial attenuation profile.

25. A method according to claim 1 further comprising when the magnetic resonance image is a spin echo image, providing an estimate of the image intensities within the object at zero echo time by dividing the estimated signal intensities within the object at the given echo time by a percentage decay in signal intensity expected within the surrounding medium at the given echo time and then dividing this result by a ratio of hydrogen proton spin density expected of the bounding medium relative to hydrogen proton spin density expected of the object itself.

26. A method according to claim 25 wherein calculating transverse relaxation rates within the object from a series of spin echo images acquired of the object and surrounding medium at different echo times.

27. A method according to claim 26 wherein when the magnetic resonance image is a spin echo image said method further comprises using the estimates of the image intensities within the object at zero echo time in the

calculation of transverse relaxation rates within the object where the estimates are determined from a spin echo time image of shortest duration in the spin echo image series.

28. A method according to claim 1 wherein when the object under consideration is the liver said surrounding medium is a layer of subcutaneous fat surrounding the abdomen.

29. A method according to claim 28 wherein when transverse relaxation rates are calculated within the liver from a series of spin echo images the subcutaneous fat is used to estimate image intensities within the liver at zero echo time to assist in the calculation of the transverse relaxation rates.

30. A method of enhancing a magnetic resonance image (MRI) of an object comprising:

obtaining an initial MRI image of the object;

estimating the spatial variation of magnetic resonance imaging radio frequency (RF) signal intensities within the object from measured RF signal intensities of a uniform spin density medium surrounding the object by:

acquiring a magnetic resonance image of an object bounded by a medium which is of essentially uniform spin density, on the length scale of resolution of the image;

formulating a semi-empirical mathematical model I(x,y) of the spatial variation in RF signal intensity within the said object;

fitting said model to selected measured RF signal intensities of said surrounding medium to obtain an estimate of the spatial variation of magnetic resonance imaging radiofrequency (RF) signal intensities within said object; and

rescaling the initial MRI image by dividing the signal intensities of the image of the object.